Wire Yagis for 30 and 40 Meters

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The quest for better wire antennas for the lower HF bands often overlooks the Yagi. We envision the Yagi as an expensive tubular beast that crumbles easily, needs a tall tower and a large rotator, and belongs only to the rich and famous. Actually, we can build a 2-element wire Yagi with no more wire then is needed for a 1 loop: just two half-wavelength copper wires properly spaced. And the whole thing will pretty closely match that extra length of coax hiding in the closet.

Figure 1 illustrates the general outlines of a 2-element Yagi consisting of a driven element and a reflector. The reflector is parasitical because it is not directly fed power. Rather, because of its length and distance from the driven element, the current on the wire is of a magnitude and phase to augment the radiation in the forward direction and to diminish it to the rear. Because the two elements are electrically interlocked, the elevation angle of maximum radiation tends to be lower than for a single wire antenna, such as a center-fed dipole.

For 40 and 30 meters, typical #14 copper wire dimensions are the following:

Dimension	**40**	**30**
El. #1 (Driven Element)	66'	46.6'
El #2 (Reflector)	70'	49.4'
Spacing	20'	14.1'

With these dimensions, the feedpoint impedance will be close to 50 , and the 2:1 SWR bandwidth should cover most of the band. (Wire antennas will have somewhat narrower SWR bandwidths than antennas made from fatter tubing.).

One of the advantages of a wire Yagi is that it requires no more wire than a full-wave loop. Unlike vertically-oriented loops, both wires of the Yagi are at the maximum height available. Therefore, standard wire antenna construction can be used throughout. The 2-element Yagi is thus a very useful step on the road to even more complex antennas in the future.

Figure 2 and **Figure 3** show the anticipated azimuth patterns of wire Yagis at antenna heights of ¼ and ½ , respectively. In each case, although some of the side rejection of an ideal beam is diminished, the antenna retains useful gain and front-to-back ratio. At ¼ up, the gain is about 8.3 dBi with a front-to-back ratio of about 8.5 dB. At ½ up, the gain climbs to about 105 dBi with about 10.5 dB front-to-back ratio. A quarter wavelength is about 35' at 40 meters and 25' at 30 meters; while a half wavelength would be twice those heights.

In addition, the elevation angle of maximum radiation is lower than a dipole at the same height. **Figure 4** compares the elevation patterns of a dipole and a wire Yagi at ½ up. The Yagi not only displaces radiation in one direction compared to the dipole; it also has about 3 dB gain over the dipole at critical DX elevation angles of 10 to 20 . DX performance should equal or exceed some of the low angle phased loops and half-squares while still permitting good contacts with nearer stations.

Who might profit from a fixed-position wire Yagi? Any operators who have a broad area toward which they would like to radiate and from which they would like to receive. This might mean someone on the borders of a country trying to work across the country. It might also mean someone wanting to work DX with too much QRM to the rear of the DX direction.

These designs have been optimized for ease of matching. Removing remnant reactance from the feedpoint should be a matter of adjusting the driven element length, an operation that will not significantly affect overall antenna performance. Although slightly more gain or front-to-back ratio can be tweaked from the design, the difference would be unlikely to make an operational difference and only make the whole array harder to match.

For less than the cost of a rotator alone, you can install 4 of these antennas, one to each of the four corners of the earth. (Supports are the builder's responsibility.) There is no one perfect antenna for every application. The wire Yagi is no exception. However, it just might fit into your antenna needs. Remember also that you need not feed the driven element with coax. With parallel feedline, you can also operate the driven element as an all-band wire for 40 meters and up. The reflector may cause a bit of distortion to normal single-wire patterns, but not enough to make the antenna a poor performer on the upper bands.

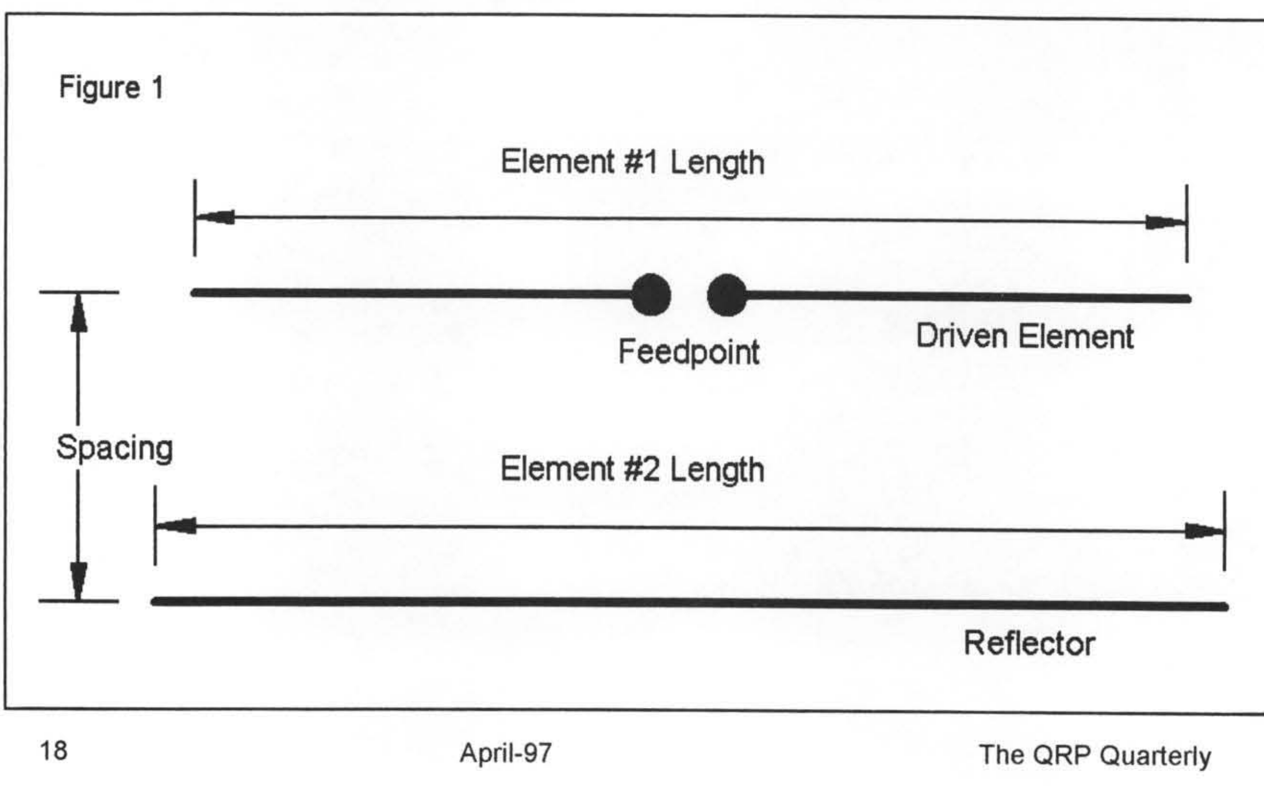

Figure 1

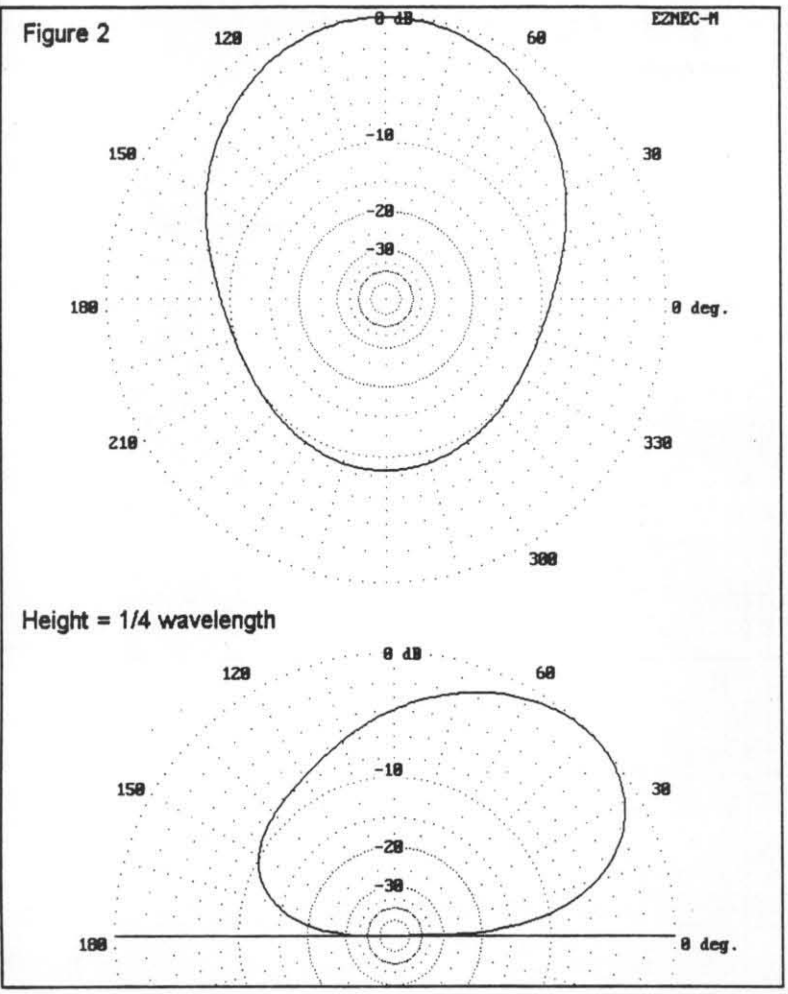

Figure 2

Height = 1/4 wavelength

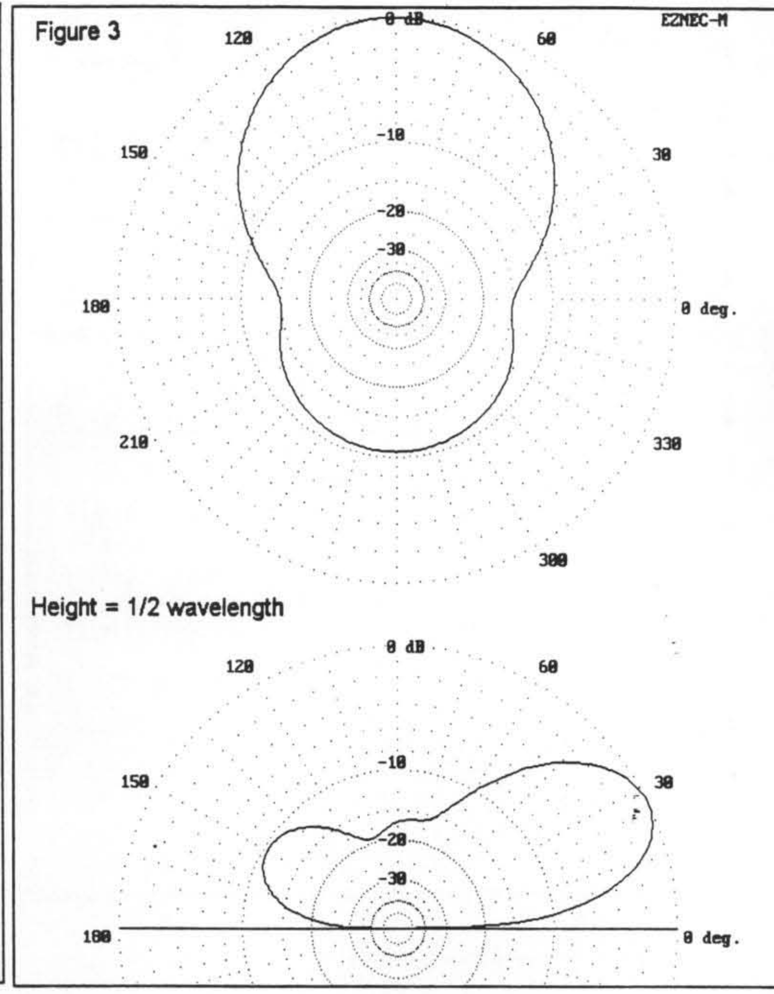

Figure 3

Height = 1/2 wavelength

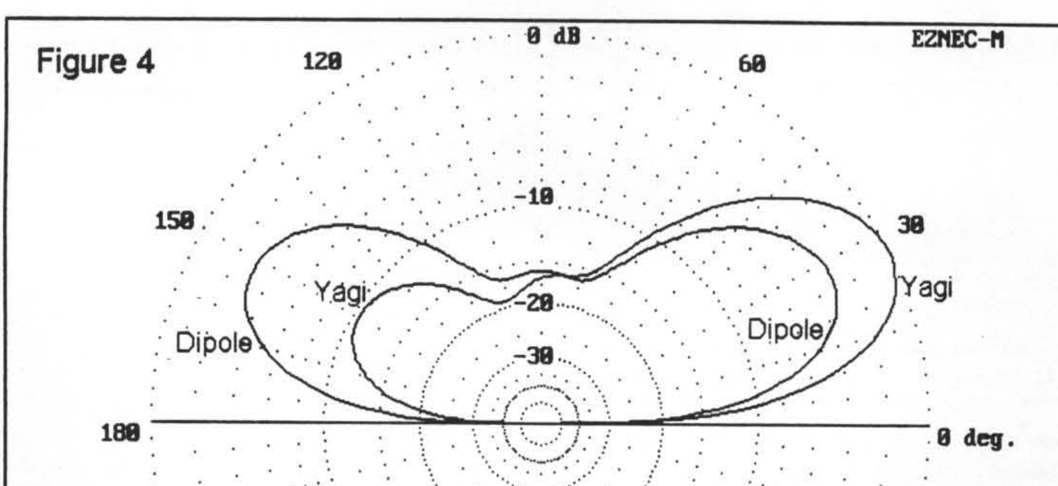

Figure 4